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"METHOD FOR TURNING OVER A CONCRETE BODY AND METHOD FOR THE PRODUCTION OF A CONCRETE VESSEL HULL AND METHOD FOR THE PRODUCTION OF A VESSEL"

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Method for turning over a concrete body and method for the production of a concrete vessel hull and method for the production of a vessel

The present invention relates to a method for turning over a concrete body that is U-shaped in cross-section, from a first position in which the free ends of the arms of the U-shape point downwards into a second position in which the free ends of the arms of the U-shape point upwards.

When pouring concrete bodies that are U-shaped in cross-section, such as concrete vessel hulls for, for example, houseboats, it is preferable if the arms of the U-shape point downwards when pouring. However, if this position is not the use position in which the concrete body is ultimately used, the corollary of this is that after pouring the concrete body the concrete body has to be turned over.

The advantage of pouring U-shaped concrete bodies with arms pointing downwards is that pouring can then be carried out essentially in one operation, or at least uninterrupted in succession. This is because in such a position there are no locations in which air inclusions and construction joints can occur. If a U-shaped concrete body is poured with the arms pointing upwards, in general it is necessary first to pour the body linking the arms, usually first allowing this body to set so as only then to be able to pour the arms pointing upwards, it usually also being necessary first to erect further formwork parts before pouring the arms. If the U-shape is poured with the arms pointing downwards the entire formwork can first be erected and the entire formwork then filled by pouring in concrete, essentially without interruption. A further advantage of pouring a U-shaped concrete body with the arms pointing downwards is that positioning of the reinforcing bars, in particular binding the reinforcing bars to one another at the location of the transition from the arms to the body linking the arms, is easier. Specifically, said transition is more easily accessible to personnel if the arms are pointing downwards. Staff then do not have to work crawling over the ground or crouching down or bending over but can work standing in the normal manner, optionally on an elevation.

As already indicated, pouring a U-shaped concrete body with the arms pointing downwards has the disadvantage, if this concrete body must have the arms pointing upwards in the use position, that the concrete body formed still has to be turned over. Especially in the case of large concrete bodies this demands a particularly large effort and deployment of personnel and machines and it must be realised that if everything does not

go well the risks of injury are high.

The aim of the present invention is, now, to provide a method for turning over such a U-shaped concrete body, which method can be performed with relatively little effort, in particular exertion of force, and, moreover, gives rise to relatively little risk of injury to personnel if turning over does not proceed well.

Said aim is achieved according to the invention by a method for turning over a concrete body that is U-shaped in cross-section, from a first position in which the free ends of the arms of the U-shape point downwards into a second position in which the free ends of the arms of the U-shape point upwards, wherein the method, for a concrete body in the first position, comprises the following steps:

(a) providing the concrete body with at least one essentially closed tank extending over the width of the U-shape, containing a freely fluid layer, such as a layer of water;

(b) making the concrete body float in water;

(c) after steps (a) and (b) exerting a rotational moment about an axis of rotation extending transversely to the U-shape on the concrete body such that the fluid layer is displaced in the direction supporting the rotational moment.

The force required to exert rotational moment can be relatively low and can even be of the order of magnitude of the force that can be exerted by a person. As soon as the concrete body has tilted a little, the fluid layer starts to flow to the low side and will then support the rotational moment and even render further exertion of said rotational moment superfluous. After it has turned through 180° about the axis of rotation, the concrete body will continue to move a little beyond this point, but because the body, comprising a heavy mass, linking the arms to one another has reached a position below the centre of gravity in the second position, the concrete body will finally come to rest in the water with its arms pointing upwards.

A fluid layer is understood to be, in particular, a layer of material that is capable of flow under the influence of gravity. The fluid layer will in particular be a fluid, such as water, but can also be made up of a granular material that is capable of flowing well or possibly of marbles. The fluid layer could also be made up of a material that is not too viscous. Per se, it is very readily conceivable that the concrete body encloses a hollow cavity that is open towards the bottom and that, when the concrete body is in a tank to be filled with water, remains filled with air and thus provides the concrete body with buoyancy. When, however, one of the arms of the concrete body then emerges from the

water surface during turning over, the air will flow out of this hollow cavity and be replaced by water, as a consequence of which the concrete body will sink. If the rotational moment is not large enough and the tank in which the concrete body is floating is insufficiently deep, the result of this will be that the concrete body does not achieve its turned-over second position because it makes contact with the bottom of the tank prematurely. In order to provide the concrete body with permanent buoyancy it is therefore preferable according to the invention if one or more floats are provided between the arms of the U-shape. In this context floats are understood to be, in particular, bodies which have a relative density lower than that of water, such as hollow bodies filled with air, foam blocks, etc. Such floats, including in the case where these are foam blocks, will already be able to be provided between the arms of the U-shape before the concrete body is turned into the position with the arms pointing upwards. In the case of foam bodies it is furthermore possible to provide these already as permanent formwork when casting the concrete body.

The so-called tanks containing a fluid layer therein can optionally be put on top of the concrete body in the first position and fixed to said concrete body. However, is it more preferential to provide the tanks within the legs of the U-shape, in which case they also act as a float, since the tanks will not be completely filled with a fluid layer.

In order to be able to exert a force on the concrete body for the purpose of generating the required rotational moment, it is preferable according to the invention if the concrete body is secured against floating off, in a manner permitting rotation about the axis of rotation. After all, otherwise there is a risk that the concrete body floats off again as a consequence of the force exerted, rather than being made to rotate.

According to the invention it is furthermore advantageous if the at least one tank is removed after the concrete body has been turned into the second position.

The invention furthermore also relates to a method for the production of a concrete vessel hull for a vessel, such as a houseboat, wherein the vessel hull is a concrete body of U-shaped cross-section, wherein the vessel hull is poured upside down in a dock and wherein after the vessel hull has set the vessel hull is turned over using the method according to the invention. Step (c) can then be carried out by allowing the dock to fill with water.

Finally, the invention also relates to a method for the production of a vessel, such as a houseboat, wherein a concrete vessel hull is produced using the method for the production

thereof according to the invention and wherein, after the vessel hull has been turned over, construction of the houseboat is completed while the vessel hull is floating in the water.

The present invention will be explained in more detail below with reference to an illustrative embodiment shown stepwise diagrammatically in the drawings. In the drawings Figures 1 to 6 show successive stages of the method according to the invention.

As is shown in Figure 1, in the case of pouring a concrete body, work will in general first be started with the production of formwork. In the case of a body that is U-shaped in cross-section and that is cast upside down, the formwork can take the form as is shown diagrammatically in Figure 1. The formwork consists of an inner formwork 2 and an outer formwork 3. If the concrete body to be made will finally have a vessel-like shape with, as it were, a base and a surrounding wall extending around the entire periphery of the base, the outer formwork 3 will then also have a closed contour in the peripheral direction. The same then also applies for the inner formwork, at least for the vertical wall sections thereof. In the illustrative embodiment given, the formwork 2, 3 is erected on the bottom of a dock 1. A tank 4 containing a layer 5 of water a few centimetres deep is placed inside the inner formwork. A minimum depth of 1 to 10 cm must be considered for the depth of the layer of water. The tank 4, as such, is closed all round and for the rest is filled with air or optionally another gas. The tank 4 can thus act as a float in a later stage of the method. It is pointed out that the tank 4 does not already have to be placed in the inner formwork immediately before pouring; this can optionally be done at a later stage.

Figure 2 shows a subsequent stage, in which concrete 6 has been poured into the formwork 2, 3. Viewed in cross-section, the concrete body 6 has a U-shape with two arms 11 and a base 12, that is for the time being located at the top. The free ends of the arms 11 are indicated by 13 and in the so-called first position shown in Figure 2 these point downwards.

Figure 3 shows a further stage in the method according to the invention. The outer formwork 3 has been removed, although this could also still be present, and the dock 1 has then been filled with water 8. This has the effect that the poured concrete body 6 is made to float, the tanks 4 providing the buoyancy. However, it is pointed out that in the so-called first position of the concrete body 6, shown in Figure 3, the tank 4 is not yet needed for buoyancy if at least the arms 11 are linked to one another at their end faces running parallel to the plane of the drawing by an end wall and a single space that is open towards the bottom is thus delimited between the arms 11.

As is indicated in Figure 3 by arrow F, a force is then exerted on the concrete body 6, which force F produces a rotational moment about the median extending transversely to the plane of the drawing and passing through the centre of gravity 7. The force F can be exerted, for example, by placing a weight on top of the body 6, by allowing a mass to drop onto the latter, or in some other way. It is also not a requirement that the force F is directed vertically downwards; what is important is that a rotational moment is produced about an axis of rotation that is transverse to the plane of the drawing. Incidentally, this axis of rotation does not necessarily have to be a median passing through the centre of gravity 7. As will be clear to those skilled in the art, the force F can, for example, also act in the horizontal direction. In the latter case it will be advantageous, in order to prevent the concrete body 6 floating off, if the concrete body 6 is secured against floating off in a manner that incidentally does permit rotation about the axis of rotation. This can be effected, for example, by securing the concrete body 6 to the dock 1 at the two end faces running parallel to the plane of the drawing by means of an anchor chain.

Figure 4 shows a further intermediate stage in turning the concrete body 6. The rotational moment is indicated by arrow M and it can clearly be seen that the layer of water 5 has collected in the bottom left corner of the tank 4 and thus produces a tilting moment that supports tilting or is subsequently entirely responsible for tilting. Once the concrete body 6 has been made to move in this way, it will continue to turn into the second position shown in Figure 5 and initially will turn beyond this position so as, after some time, to come to rest in the position shown in Figure 5, with or without restraint. In contrast to the position shown in Figure 3, the position shown in Figure 5 is a stable position. The reason for this is that the major proportion of the mass of the concrete body 6 is below the centre of gravity 7. Insofar as this has not already been done, the inner formwork and the tank 4 containing the layer 5 of water therein can now be removed. A superstructure 9 can then be erected on the concrete body 6 in the dock 1 or optionally outside the dock 1 in open water or in the water in some other way. A houseboat or barge with a concrete vessel hull 6 can, for example, be built in this way.